

Measure of Center

Mean

The mean is commonly referred to as the average.

The population mean is the average of the population data.

Here is the formula for the Population Mean: $\mu = \frac{\sum x}{N}$

Suppose we want to discuss the adults who moved to Phoenix in 2012 from outside of the state of Arizona to become residents. We want to find the mean age of those people. To find the population mean age we would need to find the age of every person who moved to Phoenix from outside the state of Arizona in 2012.

In this example there were a total of 50 people who moved to Phoenix from outside AZ.

There ages are placed here.

25	20	32	31	45	69	70	76	27	45
46	47	37	38	22	31	33	51	55	46
63	41	80	35	36	36	65	25	25	34
37	59	59	45	44	34	29	27	29	32
72	64	63	36	48	37	31	21	21	22

Once we have the ages, we add them up getting a total of 2096 and then we divide that number by the number of ages we have.

$$\mu = \frac{\sum x}{N} = \frac{25 + 20 + 32 + 31 + 45 + 69 + 70 + 76 + 27 + 45 + 46 + 47 + 37 + 38 + 22 + 31 + 33 + 51 + 55 + 46 + 63 + 41 + 80 + 35 + 36 + 36 + 65 + 25 + 25 + 34 + 37 + 59 + 59 + 45 + 44 + 34 + 29 + 27 + 29 + 32 + 72 + 64 + 63 + 36 + 48 + 37 + 31 + 21 + 21 + 22}{50}$$
$$\mu = \frac{\sum x}{N} = \frac{2096}{50} = 41.92$$

We now have the mean age of all those that moved to Phoenix from outside of AZ in 2012.

Sample Mean

The sample mean is the average of the sample data. Sometimes it is difficult to get information from every member of the population so we take a sample of the population to make our calculations.

Here is the formula for the Sample Mean: $\bar{x} = \frac{\sum x}{n}$

Using the same example of the adults who moved to Phoenix in 2012 from outside of the state of Arizona to become residents. We want to find the mean age of those people. There were 50 adults who moved to Phoenix from outside AZ in 2012 in our original data. We want to take a look at a random sample of 20 adults. To find the sample mean we add the ages of the randomly sampled 20 ages which come to 952 and divide by 20 (the sample size).

25	37	72	47	72	41	59	32	59	37
80	63	80	31	38	31	45	36	45	22

$$\bar{x} = \frac{\sum x}{n} = \frac{25+37+72+47+72+41+59+32+59+37+80+63+80+31+38+31+45+36+45+22}{20}$$

$$\bar{x} = \frac{\sum x}{n} = \frac{952}{20} = 47.6$$

We now have the sample mean age of all those that moved to Phoenix from outside of AZ in 2012.

Median

The median is the exact center of the data. This is the point so that half of the data is to the left of the median and half of the data is to the right. The median can be found for population data and/or sample data.

Using the same example of the adults who moved to Phoenix in 2012 from outside of the state of Arizona to become residents. We will want to take all their ages and find the median.

To calculate the Median:

Arrange the data values from smallest to largest

If the number of observations n is odd the median is the center observation in the ordered list. (It is at the location in the list)

If the number of observations n is even, the median is the average of the two observations in the middle.

In this first example we will take a sample of 25 adults who move to Phoenix in 2011 out of the population of 50.

First: Arrange data from smallest to largest

22
25
31
31
31
32
36
37
37
38
41
44
45
45
47
48
48
59

59
63
72
72
80
80

Step 2: If the number of observations n is odd the median is the center observation in the ordered list. (It is at the location in the list)

The median is 45 since it is in the middle (observation 13).

Suppose we take a sample of 20 adults instead.

Again: Arrange data from smallest to largest

22
25
31
31
32
36
37
37
38
41
45
45
47
59
59
63
72
72
80
80

Now since the number of observations n is even, the median is the average of the two observations in the middle. Here is the formula for this calculation. We now know the median from an even number observation is 43.

$$M = \frac{41+45}{2} = \frac{86}{2} = 43$$

Mode

The mode of a data set is the value that occurs most frequently. The mode can be found on population data and/or sample data.

When two values occur with the same greatest frequency, each one is a mode and the data set is bimodal.

When more than two values occur with the same greatest frequency, each is a mode and the data set is said to be multimodal.

When no values repeat, there is no mode.

Notice that 25 occurs 3 times in the data, which is more than any other data value, so 25 is the mode.

25

46

63

37

72

20

47

41

59

64

32

37

80

59

63

31

38

35

45

36

45

22

36
44
48
69
31
36
34
37
70
33
65
29
31
76
51
25
27
21
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25
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21
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46
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32
22